SNI ISO 374-4:2019
(Ditetapkan oleh BSN tahun 2020)

SNI
Standar Nasional Indonesia

Sarung tangan pelindung terhadap bahan kimia berbahaya dan mikroorganisme – Bagian 4: Penentuan ketahanan terhadap degradasi oleh bahan kimia

(ISO 374-4:2019, IDT, Eng)

ICS 13.340.40

BADAN STANDARDISASI NASIONAL

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Diterbitkan di Jakarta

Daftar isi

Prakata

Standar Nasional Indonesia (SNI) ISO 374-4:2019, dengan judul *Sarung tangan pelindung terhadap bahan kimia berbahaya dan mikroorganisme – Bagian 4: Penentuan ketahanan terhadap degradasi oleh bahan kimia (ISO 374-4:2019, IDT, Eng)*, merupakan hasil adopsi identik dari standar ISO 374-4:2019 *Protective gloves against dangerous chemicals and micro-organisms — Part 4: Determination of resistance to degradation by chemicals*, dengan metode republikasi *reprint*, yang ditetapkan oleh BSN pada tahun 2020.

Standar ini disusun oleh Komite Teknis 13-09 Biosafety and Biosecurity dengan Badan Standardisasi Nasional (BSN) sebagai sekretariat Komite Teknis. Standar ini telah dibahas dalam rapat teknis, dan terakhir disepakati dalam rapat konsensus di Jakarta pada tanggal 17 April 2020 yang dihadiri oleh para pemangku kepentingan (*stakeholder*) terkait, yaitu perwakilan dari produsen, konsumen, pakar dan pemerintah, serta perwakilan dari lembaga penguji, asosiasi, perguruan tinggi, pakar serta instansi terkait.

Standar ini telah melalui tahap jajak pendapat pada tanggal 11 Mei 2020 sampai dengan 30 Mei 2020 dengan hasil akhir disetujui menjadi SNI.

Apabila di kemudian hari pengguna menemukan kesulitan dalam penggunaan standar ini, maka dianjurkan untuk merujuk pada standar aslinya yaitu ISO 374-4:2019 dan/atau dokumen terkait lain yang menyertainya.

Perlu diperhatikan bahwa kemungkinan beberapa unsur dari dokumen standar ini dapat berupa hak paten. Badan Standardisasi Nasional tidak bertanggungjawab untuk pengidentifikasian salah satu atau seluruh hak paten yang ada.

Sarung tangan pelindung terhadap bahan kimia berbahaya dan mikroorganisme – Bagian 4: Penentuan ketahanan terhadap degradasi oleh bahan kimia

1 Scope

This document specifies the test method for the determination of the resistance of protective glove materials to degradation by dangerous chemicals with continuous contact.

NOTE Annex A gives information on interlaboratory test results on this method.

It is preferable that other tests used in addition to the evaluation of chemical resistance such as permeation resistance and penetration, as the chemical test do not provide sufficient information on the physical property changes affecting a glove during exposure to a chemical. It is necessary that the outside surface of the glove be exposed to the chemical.

2 Normative reference

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 374-1, *Protective gloves against dangerous chemicals and micro-organisms — Part 1: Terminology and performance requirements for chemical risks*

ISO 21420, *Protective gloves — General requirements and test methods*

ISO 23388:2018, *Protective gloves against mechanical risks*

3 Term and definition

For the purposes of this document, the terms and definitions given in ISO 374-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Test principles

The resistance of a protective glove material to degradation by a liquid chemical is determined by measuring the change in puncture resistance of the glove material after continuous contact of the external surface with the challenge test chemical. The test is applicable to gloves made of natural or synthetic polymer. Lined gloves can produce unusable measurement results.

5 Test methods, puncture resistance test

5.1 Sampling

Select three gloves for testing. Condition the gloves at (23 ± 2) °C, (50 ± 5) % relative humidity for at least 24 h.

In the case of irregular and/or multiple construction, one sample shall be tested from each area. Using the appropriate circular die of 20 mm, cut 6 specimens of each glove for a total of 18 test specimens. For each glove, 3 specimens will be exposed to the challenge chemical and 3 specimens will be unexposed.

Select specimens so that they are homogeneous and representative of the glove’s primary construction. Avoid embossed patterned areas or other areas of varying thickness or composition when cutting these specimens.

If a glove is constituted of several unbounded layers, only the layer giving the chemical protection shall be tested.

The sample shall be tested according to the method described in 5.3. An additional non-mandatory informative test method is given as an example in Annex B.

For lined gloves, if it is not possible to separate the liner from the glove (and if the liner is too thick), the test could not be feasible, because it would not be possible to seal the vial and the sample would slide during the test. For some samples, if there is a thick liner, it could not be necessary to use the septa to have a correct vial sealing. In this case, the liner will ensure the leakproofness.

5.2 Apparatus

The following equipment shall be used:

a) (20 ± 1) mm diameter cutting die;

b) (12 ± 1) mm diameter cutting die (for cutting a hole in the centre of each septum);

c) 20 ml crimp top vials (opening (12,5 ± 0,5) mm of diameter);

d) 20 mm diameter septa (e.g. made from chlorobutyl rubber without polytetrafluoroethylene (PTFE) layer);

e) 20 mm open centre aluminium crimp seals;

f) hand crimper;

g) hand decapper;

h) punched-out sample holder with 18 holes of 20 mm diameter;

i) 150 ml beaker;

j) transfer pipette, 2 ml;

k) dynamometer with a puncture stylus according to ISO 23388:2018, 6.5 and a cell to measure compression forces with a precision of ±1 %;

l) sample vial support.

5.3 Procedure

5.3.1 Test conditions

The test shall be conducted at (23 ± 2) °C (preparation, chemical, exposure to chemical, and puncture test).

5.3.2 Pre-testing measurements

Place the challenge chemical into the 150 ml beaker. Using the transfer pipette, place about 2 ml of challenge chemical into one of the crimp top vials.

Seat a septum in an open centre aluminium crimp seal cap. Using the (12 ± 1) mm cutting die, make a centred hole in the septum.

Place a glove specimen on top of the septum with its normal external surface facing towards the interior of the vial. Place the aluminium cap with the specimen on top of the vial. Seal the vial using the hand crimper and invert it so that the challenge chemical is in contact with the specimen (see Figure 1). Record the time. Place the vial in the punched-out sample holder.

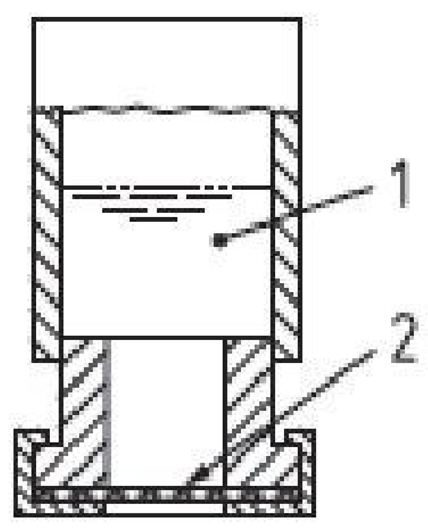
NOTE The punched-out sample holder has a twofold purpose:

a) It allows air to circulate under the sample film, and

b) if the pressure from the challenge chemical forces the sample into a convex shape, the flask will still stand.

Repeat the procedure in the above paragraph for each of the remaining eight specimens that are to be exposed. Time these actions so that the exposures on succeeding specimens begin at three-minute intervals. At the end of the one-hour exposure period (±5 min), examine each test vial to confirm coverage of the specimen with the challenge chemical. If the chemical is not covering the specimen, discard the specimen and repeat the test using a larger quantity of challenge chemical.

Mount the nine unexposed specimens in the remaining vials in the same manner, except that no chemical is placed in the vial.

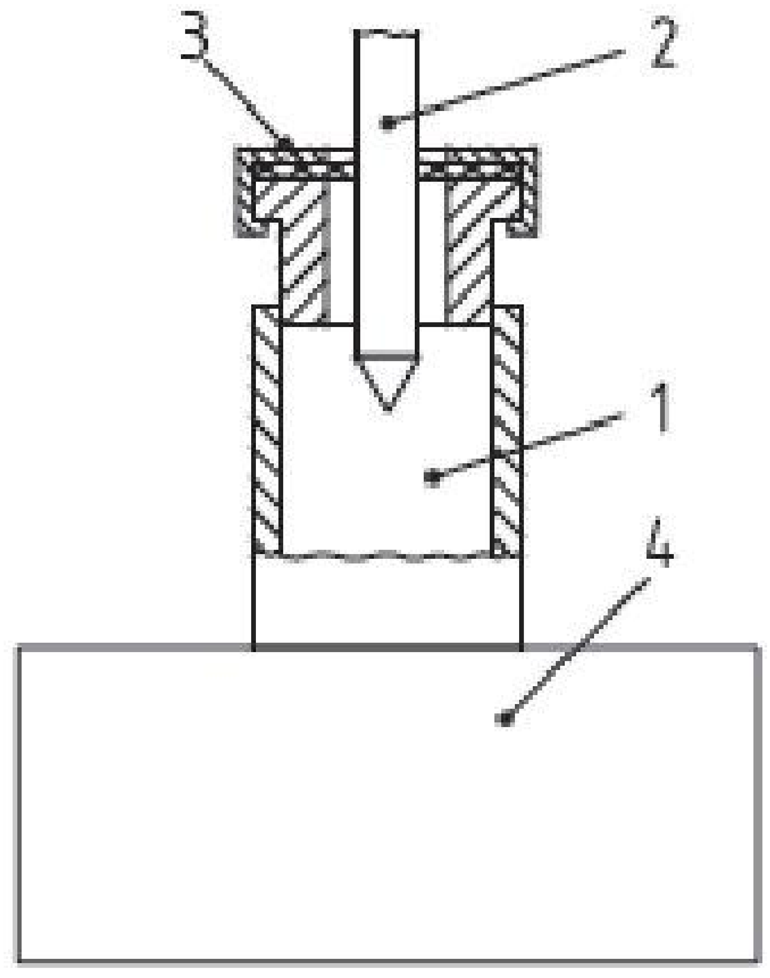


Key

1 challenge chemical

2 outer surface of the glove specimen which is in contact with the challenge chemical, it is a circular area of (12,5 ± 0,5) mm diameter

Figure 1 — Position of the vial during contact time between the specimen and the challenge chemical



Key

1 20 ml crimp vial
2 puncture stylus
3 specimen
4 sample vial support (to be maintained by the dynamometer jaw)

Figure 2 — Position of the vial during puncture test

5.3.3 Puncture testing

Install the puncture stylus on the dynamometer load cell. Set the carriage speed to 100 mm/min and screw the vial support onto the table.

Place a vial into the support. Puncture the specimen and record the peak force required (see Figure 2).

Repeat for each of the specimens; test each of the exposed specimens one hour after the exposure on that specimen was started.

Test specimens shall be examined for any changes to their physical properties during and after the test (after drying). Any changes such as swelling, shrinking, brittleness, hardening, softening, flaking, disintegration, colour change/bleeding, delaminating shall be noted and described on the test report for information.

5.3.4 Expression of results

Determine the degradation for each of the three glove samples against each specific chemical or chemical mixture using the formula:

$$DR_x = \frac{(OP_x - RPx)}{OP_x} \times 100 \qquad (1)$$

where

DRx is the degradation of the *x* glove sample against challenge chemical tested, in %;
OPx is the average puncture force on the three unexposed test specimens from the *x* glove sample; units shall be same as *RPx*;
RPx is the average puncture force on the three exposed test specimens from the x glove sample; units shall be same as *OPx*.

Determine the degradation of the glove material against the challenge chemical using the following Formula (2):

$$DR = \frac{(DR1+DR2+DR3)}{3} \quad (2)$$

where

DR is the degradation of the glove material against challenge chemical tested, in %;

*DR*1 is the degradation of the first glove sample against challenge chemical tested, in %;

*DR*2 is the degradation of the second glove sample against challenge chemical tested, in %;

*DR*3 is the degradation of the third glove sample against challenge chemical tested, in %.

Determine the standard deviation (SD) of the degradation for the three glove samples.

6 Test report

For each protective glove material tested, a report shall include the following information:

a) Report the manufacturer's reference for the glove tested including the material, style, and lot number.

b) Report the name of the test chemical, its purity, and if it is in a mixture, its concentration and other components.

c) Make reference to this document.

d) Report the date of the test.

e) Report *DR*1, *DR*2, *DR*3, *DR* (see 5.3.4), the percent change in the puncture for the glove material. The SD shall also be reported.

f) Report whether the liner, if present, has been separated from the test specimen.

g) Report any observations of changes in the physical appearance of the material specimens following chemical exposure. Examples of reported observations are swelling, shrinking, brittleness, hardening, softening, flaking, disintegration, colour change/bleeding and delaminating.

h) Any deviation to this document shall be reported.

Annex A
(informative)
Inter laboratory test on the present test method

The following degradation data (see Tables A.1 and A.2) have been obtained in a collaborative correlation trial carried on by several laboratories, using the test method described in Clause 5.

Table A.1 — Results in % of correlation trial with natural rubber gloves (thickness 0,6 mm)

Laboratory	Ethyl acetate		Heptane	
	Mean value	Standard deviation	Mean value	Standard deviation
1	43	6,8	66	4,0
2	37	10	61	7,0
3	36	5,9	47	1,6
4	39	4,5	49	2,8
5	40	5,3	56	6,1
6	32	2,8	51	8,1
7	—	—	56	2,4
Mean value	37,8	5,9	55,1	4,6

Table A.2 — Results in % of correlation trial with other gloves materials

Laboratory	Acetone			Sulfuric acid		
	Mean value for Nitrile glove	Mean value for PVC glove	Mean value for Poly-chloroprene glove	Mean value for Nitrile glove	Mean value for PVC glove	Mean value for Poly-chloroprene glove
1	85	90	65	49	−36	3
2	89	86	63	57	−55	6
3	88	98	60	46	−50	−6
4	86	89	60	57	−41	5
5	92	87	—	40	−31	—
6	—	—	—	62	—	13

Annex B
(informative)
Weight change test

B.1 General

This method is only dedicated to material assessment and does not take into account the actual use of a personal protective equipment (PPE). This annex describes another test method for the determination of the resistance of materials to degradation by chemicals under continuous contact by weight change test.

B.2 Sampling

The glove should be conditioned at (23 ± 2) °C for at least 24 h. The specimens should be taken from three gloves. Put the glove flat on a surface and measure (60 ± 2) mm from fingertip. The specimens should consist of a cut-off of the same finger of each glove.

B.3 Apparatus

B.3.1 Analytical balance, accurate to 0,001 g, used to determine weight.

B.3.2 Beakers, e.g. a 50 ml glass beaker or other container (depth of at least 5,1 cm).

B.3.3 Time measuring device, a stopwatch or other timing devices.

B.3.4 Test tube with a weight, or other device to hold specimen upright in beaker.

B.3.5 Covered weighing dish, for holding specimens during weighing.

B.4 Procedure

B.4.1 Measurements

Measure the original weight of each finger specimen to the nearest 0,001 g.

B.4.2 Test conditions

The test should be conducted at (23 ± 2) °C (preparation, chemical, and exposure to chemical).

B.4.3 Procedure

Start the timer and immerse the finger specimen in a beaker containing the test chemical. The weighed test tube will hold the specimen upright in the beaker. The beaker should be filled to a depth of (42 ± 2) mm with the test chemical (see Figure B.1). The quantity of the test chemical should be adapted during the test to keep the beaker filled to the marking. Multiple finger specimens can be started at approximately 1 minute timed intervals to allow for weighing of the specimens.

Dimensions in millimetres

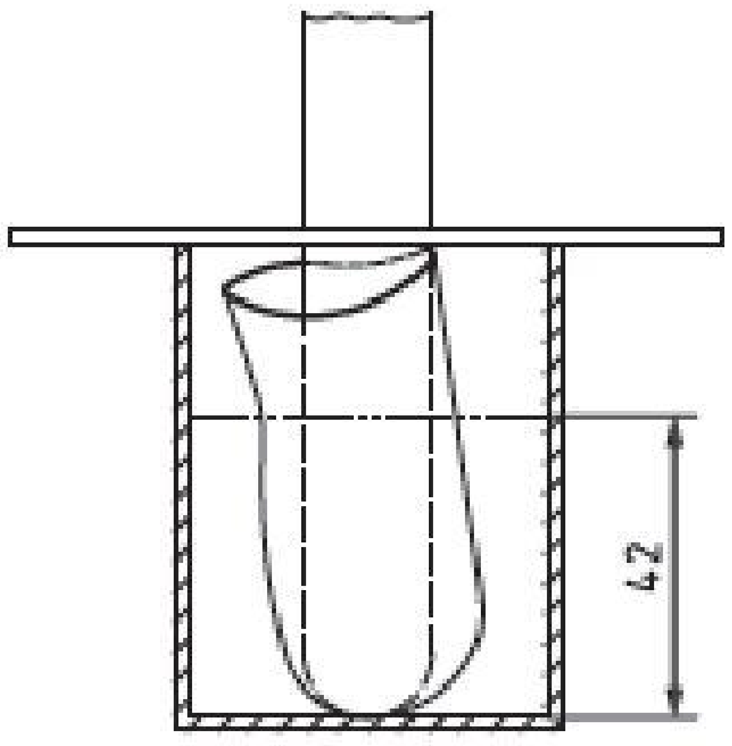


Figure B.1 — Typical arrangement of weight change test apparatus

After 60 min (±5 min) of exposure, remove the finger specimen from the chemical, lightly blot dry with a clean towel to remove surface liquid, place in a covered weighing dish, and record the specimen weight to an accuracy to the nearest 0,001 g. The weighing of the finger specimen should be carried out as quickly as possible after the 60 min chemical exposure.

Finger specimens should be examined for any changes in their physical properties during and after the test (after drying). Any changes such as swelling, shrinking, brittleness, hardening, softening, flaking, disintegration, colour change/bleeding, delaminating should be noted and described in the test report.

B.4.4 Calculation

Calculate the percent weight change based on the initial weight. The weight change can be positive (increase) or negative (decrease). Calculate the change in weight between the original specimen and the specimen weight after 60 min of exposure. Divide this difference by the original weight and multiply by 100 to obtain the percent weight change.

Determine an average of the percent weight change for the three test specimens. Also determine the standard deviation (SD) of the percent weight change for the three test specimens.

B.4.5 Expression of results

The weight change results and SD are expressed in percent.

B.5 Test report

For each protective glove material tested, a report should include the following information:

a) Report the manufacturer's reference for the glove tested including the material, style, and lot number.

b) Report the name of the test chemical, and if it is in a mixture, its concentration and other components.

c) Make reference to this document, i.e. ISO 374-4:2019.

d) Report the percent change in weight for each specimen and the average value and SD.

e) Report the date of the test.

f) Report any observations of changes in the physical appearance of the material specimens following chemical exposure. Examples of reported observations are swelling, shrinking, brittleness, hardening, softening, flaking, disintegration, colour change/bleeding and delaminating.

g) Any deviation to the document should be reported.

Informasi pendukung terkait perumus standar

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